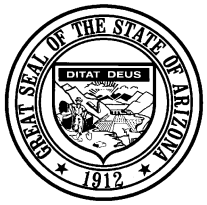
STROKE HOSPITALIZATIONS IN MARICOPA COUNTY

1998 STATUS REPORT

A Report to the Provider Education Committee of *Operation Stroke*

September 14, 2000

Epidemiology Report #2000-03



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ABSTRACT

The American Stroke Association sponsors the *Operation Stroke* campaign to control and prevent stroke and its risk factors. The following report analyzes baseline data about Maricopa county residents who have been discharged with cerebrovascular disease. The 1998 hospital discharge database shows that 7091 persons were discharged from Maricopa county hospitals with a principal diagnosis of acute cerebrovascular disease. A subset of 2947 persons had vascular occlusion with cerebral infarction ("occlusive stroke"). Patients with occlusive stroke stayed an average of 5.0 days in the hospital and generated average charges of $16,649; their total hospital charges summed to $49 million. Sixty-one percent of the cases of occlusive stroke were discharged to institutions for various levels of nursing or supportive care or other services such as rehabilitation.

The Arizona Department of Health Services will continue to collect data about persons discharged each year for stroke. The findings will be shared with *Operation Stroke* to support the development of programs to reduce stroke and risk of stroke.

STROKE IN MARICOPA COUNTY, 1998

INTRODUCTION

This report is written to support the work of *Operation Stroke*, a program of the American Stroke Association and its companion organization the American Heart Association. One of the goals of *Operation Stroke* is "... to reduce stroke and risk of stroke by 25% by 2008."[1] The objective of this report is to provide basic information about persons discharged for stroke from hospitals in 1998. This information can be used in planning the prevention and control activities of *Operation Stroke* and also in estimating the need for follow-up services. We also intend that it be used, in part, to monitor the progress of the program.

BACKGROUND

Stroke is the most common disabling neurological disease of adult life, the third leading cause of death in the developed world, and an important cause of hospital admission and long-term morbidity in most industrialized countries. In Arizona, stroke was listed as the underlying cause of death of 2414 persons in 1998, ranking only behind heart disease and cancer.[2] The total cost of stroke in the United States is estimated at $51.3 billion for the year 1999, with direct costs for medical care and therapy estimated at about $30.6 billion and indirect costs from lost of productivity estimated at $20.7 billion per year.[3]

This document analyzes data about persons hospitalized due to stroke in Arizona.

Its purpose is to assess the incidence, cost, and demographic characteristics of persons with this disease. The Provider Education Committee of *Operation Stroke* has proposed two activities of particular relevance to this document: 1) early recognition of occlusive stroke and prompt administration of clot-dissolving medicines, and 2) educational programs to begin in the year 2000 with an initial focus of activities in Maricopa county. In support of those activities this document looks at stroke hospitalizations occurring in Arizona and specifically in Maricopa county.

STROKE

A stroke is a form of cardiovascular disease that affects the arteries of the brain. A stroke occurs when a blood vessel that supplies oxygen and nutrients to the brain bursts or is clogged by a blood clot or other tissue. This rupture or blockage keeps part of the brain from getting the oxygen it needs. Without oxygen, the nerve cells in that area cannot function and die within minutes. Most of the strokes occurring in this country are occlusive strokes caused by a clot in a blood vessel narrowed by atherosclerosis. Less common are embolic strokes (in which a clot is carried in the bloodstream until it becomes lodged in a narrowed vessel) and hemorrhagic strokes (due to the bursting of a blood vessel). Every stroke is different, depending on the cause and the area of the brain injured.

DATA SOURCE: HOSPITAL DISCHARGE DATA

Hospital discharge data contain information about the principal diagnosis chiefly responsible for causing the hospitalization, as well as secondary diagnoses. These data can be used to describe persons discharged for cerebrovascular disease. This information is reported routinely to the Arizona Department of Health Services (ADHS) by all hospitals throughout the state, with the exception of Veteran Administration Hospitals, military hospitals, and Indian Health Service Hospitals (these federal facilities maintain their own data). According to the reporting rules of ADHS, hospitals must record the ICD-9-CM code describing the condition chiefly responsible for causing the hospitalization. Currently, hospital discharge data is the only systematic data source about the incidence, gender, age, residence, hospital charges, and payer type of persons with acute strokes.

CASE DEFINITION

We used the following criteria to define a case of acute cerebrovascular disease:

1. The person was discharged in 1998 from an acute care hospital in Arizona, regardless of place of residence (in state or out-of-state) and the discharge record was included in the Hospital Discharge Data submitted to the ADHS Section of Cost Reporting and Review.

2. The person's principal diagnosis was an ICD-9-CM code between 430 and 437 inclusive.

3. Records with an *admit type* of "emergency" or "urgent" were included, but records with an *admit type* of "elective" were excluded from further analysis.

4. Persons discharged more than once at a hospital, or to more than one hospital, were counted multiple times because there is no unique identifier that would allow us to merge cases seen at different hospitals.

Table 1 describes the ICD-9-CM* codes (mostly truncated at the three-digit level without the decimal place) used in this report. Codes 433-434 with a decimal extension of ".x1" cover the conditions we define as "occlusion with brain infarction (occlusive stroke)."

Table 1. Principal ICD-9-CM diagnosis codes, 430-437, used to categorize the various types of cerebrovascular disease.

ICD-9-CM code	ICD-9-CM Description	Our Grouped Codes	Our Term
430	Subarachnoid hemorrhage	430-432	Hemorrhagic stroke
431	Intracerebral hemorrhage		
432	Other and unspecified intracranial hemorrhage		
433.x0	Occlusion and stenosis of precerebral arteries without cerebral infarction	433.x0 - 434.x0	Occlusion w/o infarction
434.x0	Occlusion of cerebral arteries without cerebral infarction		
433.x1	**Occlusion and stenosis of precerebral arteries with cerebral infarction**	**433.x1 - 434.x1**	**Occlusion w/ brain infarction (Occlusive Stroke)**
434.x1	**Occlusion of cerebral arteries with cerebral infarction**		
435	Transient cerebral ischemia	435	Transient cerebral ischemia
436	Acute, but ill defined, cerebrovascular disease	436	Acute, ill-defined stroke
437	Other and ill-defined cerebrovascular disease	437	Other and ill-defined

We chose not to include code 436 in the definition of "occlusive stroke" because it lacks specificity as to the type of stroke.§

*International Classification of Diseases, 9th revision, Clinical Modification

§ The ICD-9-CM manual describes the following terms within code **436, Acute, but ill-defined, cerebrovascular disease**. Apoplexy, apoplectic: NOS, attack, cerebral, seizure; Cerebral seizure; Cerebrovascular accident [CVA] NOS; Stroke.

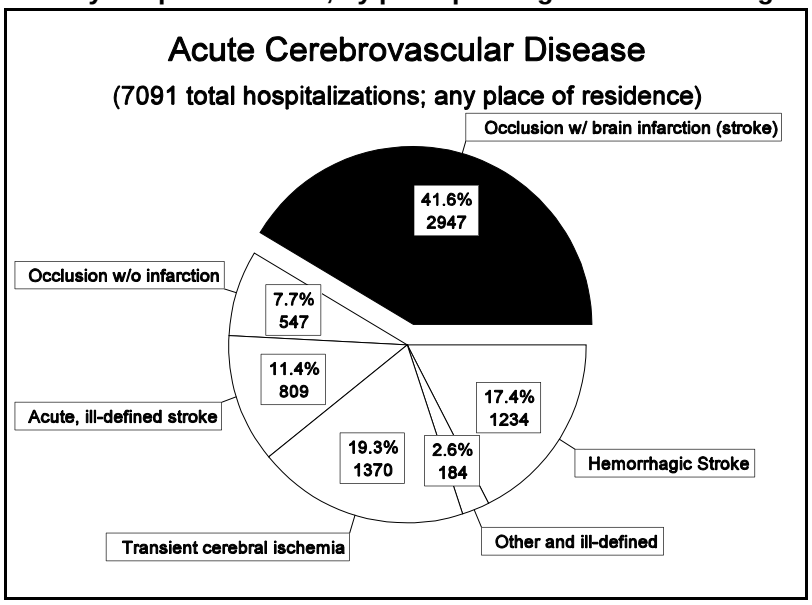
FINDINGS

From a statewide perspective, there were 11,430 hospitalized cases of acute cerebrovascular disease documented in Arizona during 1998 at non federal hospitals. The situation in Maricopa county is described below in detail.

Discharges from Maricopa county hospitals

Hospitals in Maricopa county discharged a total of 7091 cases of acute cerebrovascular disease in 1998. The residence of these cases could be either within or outside of Maricopa county. Of these 7091 cases, there were 2947 cases (41.6%, [**Figure 1**]) with a principal discharge code indicative of the condition we have termed "occlusive stroke". The rest of this subsection deals only with these 2947 cases of occlusive stroke.

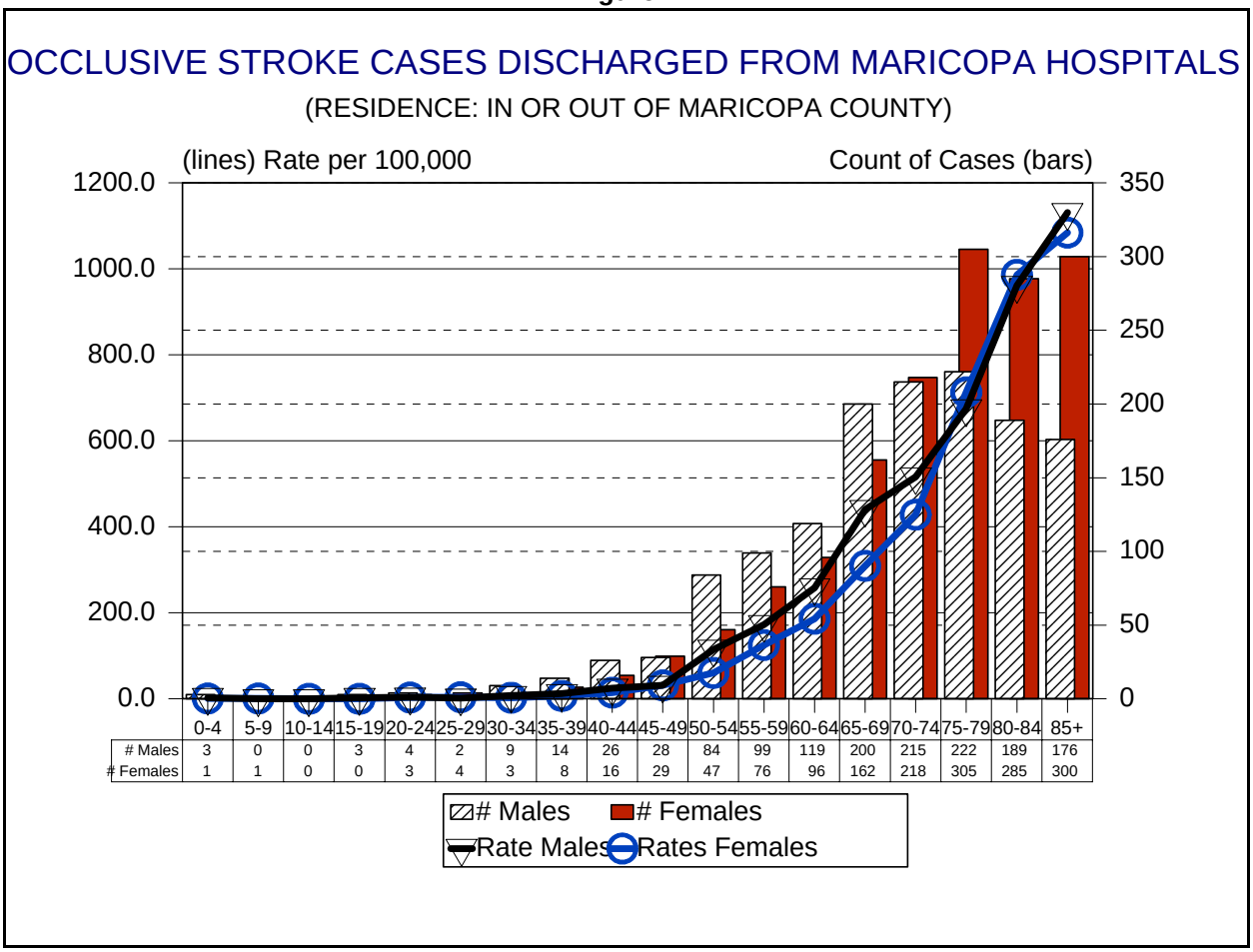
Figure 1. Acute cerebrovascular discharges from Maricopa county hospitals in 1998, by principal diagnosis at discharge.



The distribution of cases by age and sex is shown in **Figure 2**. The figure clearly shows that the rate of occlusive stroke increases markedly according to age. The numerator in this graph is obtained by counting cases, regardless of their home address,

who were discharged from Maricopa hospitals. For the denominator we used the Maricopa resident population.[4] Accordingly, the age-adjusted hospitalization rate for occlusive stroke is 107.7 per 100 000 population (adjusted to the standard Year 2000 population as shown on page 19, **Table 3**).

Figure 2



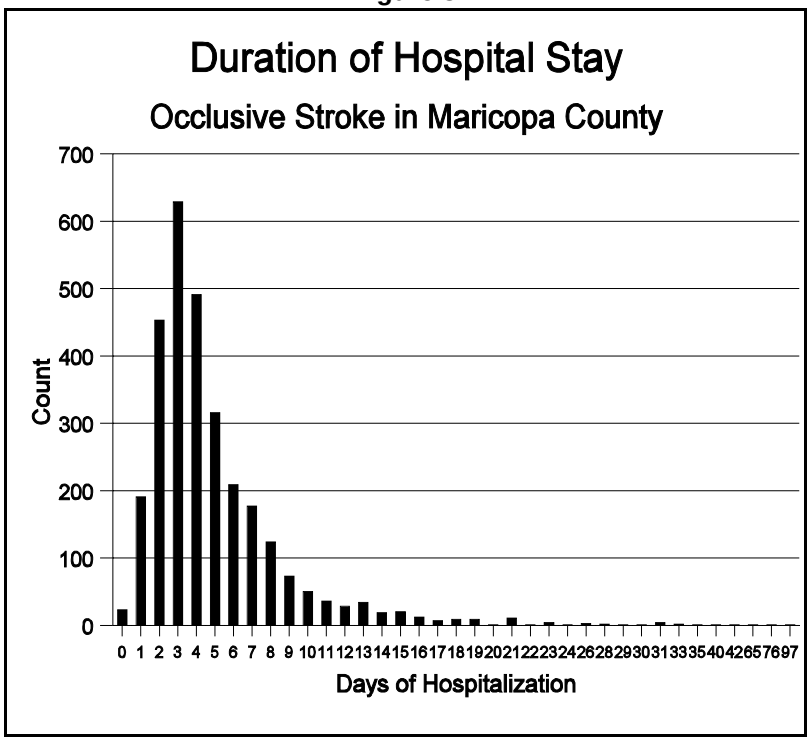
As expected, most cases discharged from Maricopa county hospitals resided in Maricopa county (**Table 2**). However, it is noteworthy that the home address of 6.7% of the cases was outside of Arizona.

Table 2. Patient's county of residence, derived from the zip code in the Hospital Discharge Database. Occlusive stroke cases discharged from Maricopa hospitals, 1998.

County of Patient	Freq	Percent
APACHE COUNTY	3	0.1%
COCHISE COUNTY	2	0.1%
COCONINO COUNTY	7	0.2%
GILA COUNTY	16	0.5%
GRAHAM COUNTY	7	0.2%
GREENLEE COUNTY	2	0.1%
LA PAZ COUNTY	15	0.5%
MARICOPA COUNTY	2536	86.1%
MOHAVE COUNTY	8	0.3%
NAVAJO COUNTY	18	0.6%
OTHER COUNTRY	11	0.4%
OTHER STATE	196	6.7%
PIMA COUNTY	6	0.2%
PINAL COUNTY	88	3.0%
YAVAPAI COUNTY	29	1.0%
YUMA COUNTY	3	0.1%
Total	2947	100.0%

The mean length of hospital stay was 5.0 days, with a wide range of this duration (**Figure 3**). The longest stay was 97 days, and the median length of hospitalization was 4 days.

Figure 3

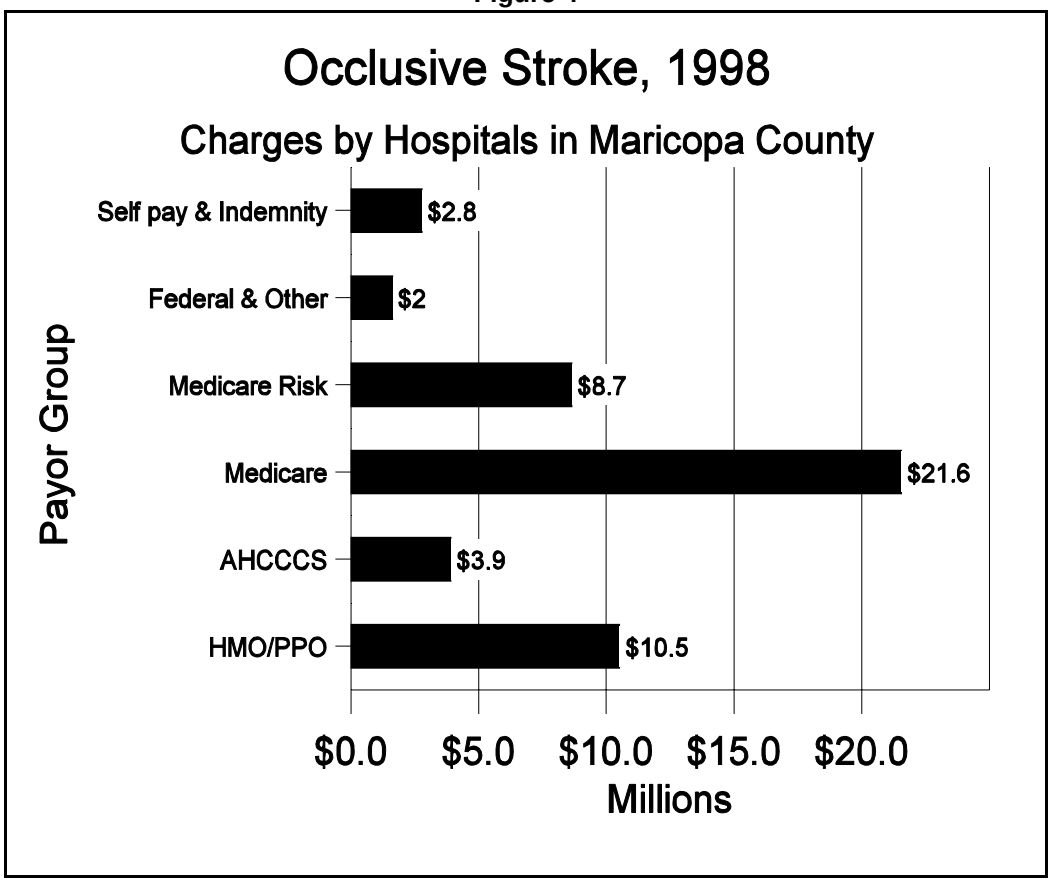


Most cases (81.0%) were admitted on an emergency basis; 19.0% were admitted on an urgent basis. As mentioned above, persons admitted electively were excluded from these analyses because we assumed that such cases probably did not really have an acute stroke.

Total hospital charges for occlusive stroke in 1998 amounted to $49,064,625. The average hospital charge was $16,649. These amounts only include the direct charges billed by the hospital, and exclude doctor charges.

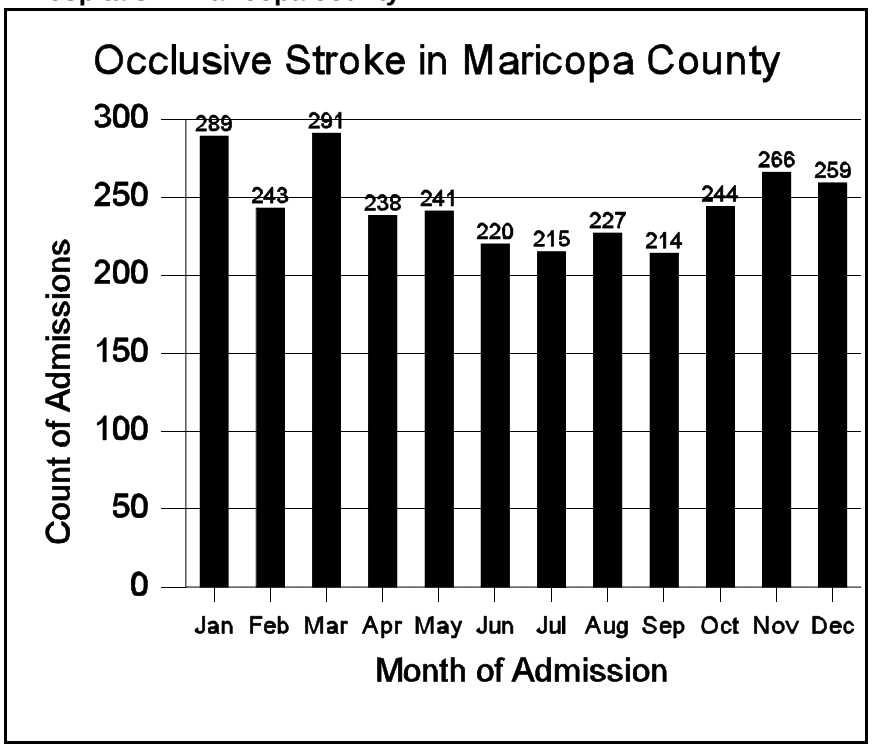
By individual payor group, Medicare incurred the greatest amount of hospital charges ($21.6 million). Combining the various forms of managed care shown in **Figure 4** reveals that their charges amounted to $23.1 million.[5]

Figure 4



Except for slightly lower admissions* during the summer, there were relatively small differences month to month (**Figure 5**).

Figure 5. Monthly admissions of 2947 occlusive stroke cases to hospitals in Maricopa county.

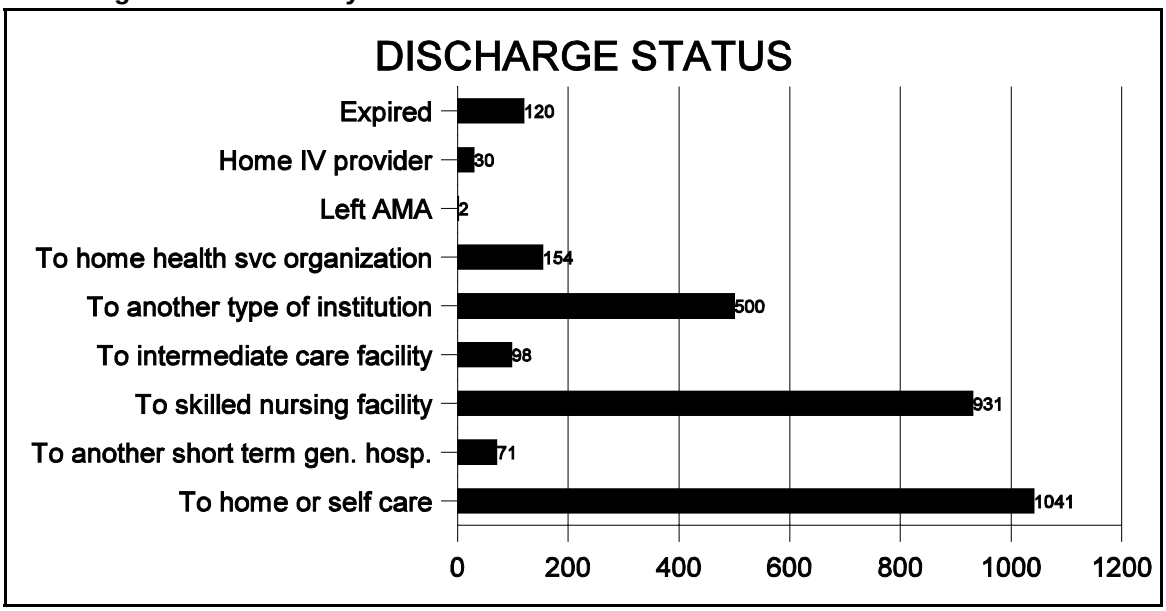


The impact of stroke also can be measured in terms of the discharge status of the case. **Figure 6** shows that only 4% of the 2947 cases died in the hospital, and that 1041 (35%) of the cases were discharged to home or self care. A direct measurement of the number of cases discharged to a rehabilitation facility is not possible with this data set

* In the analysis in this paragraph we looked at the month of admission rather than month of discharge.

because that option is not a specific discharge code. Subtraction of the cases who died, left against medical advice, or who were discharged to home/self care show 1784 cases* (61%) who were referred to institutions for various levels of nursing care, supportive care, or other institutional services such as rehabilitation. This assessment of the severity of the stroke is useful in measuring the needs for services. A matrix of the source of admission and the discharge disposition of the cases is shown in the Appendix, page 20, **Table 4**.

Figure 6. Location where patients with occlusive stroke went upon discharge. The categories are mutually exclusive.



Clot-dissolving medications

Analysis of the procedure codes shows that few cases (4 to be precise) of occlusive stroke were administered clot-dissolving medications in 1998. Several factors

* Calculation from **Figure 6**: 2947 - [120+2+1041] = 1784

may account for this finding. The procedure (which was approved by the FDA starting in June 1996[6]) might have been performed only rarely in 1998. Also, the procedure might not have been documented with the code 99.10. We believe that tracking this code in future years will prove useful in monitoring the use of clot-dissolving medications. The facilities from which patients with occlusive stroke were discharged in 1998 is shown in **Table 6**.

DISCUSSION

Stroke can alter a life in minutes, leaving an aftermath of paralysis, speech problems, memory deficits, and other long term impairments. *Operation Stroke* can implement educational programs to alert the public and doctors about the early warning signs of stroke. Educational programs to prevent stroke from occurring also might help to achieve the goals of Operation Stroke.

Limitations of the data

Only discharges from non federal facilities have been included in these analyses. The addition of cases occurring at Veteran's and Indian Health facilities would certainly raise the numbers of cases, were they to be included. Our analyses assume that the diagnosis coders at hospitals conduct their assignments of principal diagnosis codes fairly and uniformly. The chart auditing conducted by Medicare and managed care payers helps to assure that this assumption is reasonable. Cases which expire prior to reaching a hospital obviously are not included in our analyses here. Cases are missed in this

analysis if the stroke code is posted in a diagnosis field that is other than the principal diagnosis field.

ICD-9-CM code #436 contained 11.4% of the 7091 discharges for acute cerebrovascular disease. We do not know what proportion of these 809 cases may have had occlusive stroke. It may be worthwhile to explore why a more definitive diagnosis was not pursued for these cases.

A careful review of hospital records might further distinguish persons admitted with a pending stroke versus a completed stroke. This type of assessment of the reliability of the data would be important to confirm the accuracy of this report. Meanwhile, by including only cases where the *admit type* is "emergency or urgent," and by eliminating cases where the admit type is "elective" we believe we present a useful description of occlusive cerebrovascular disease with cerebral infarction.

Future plans

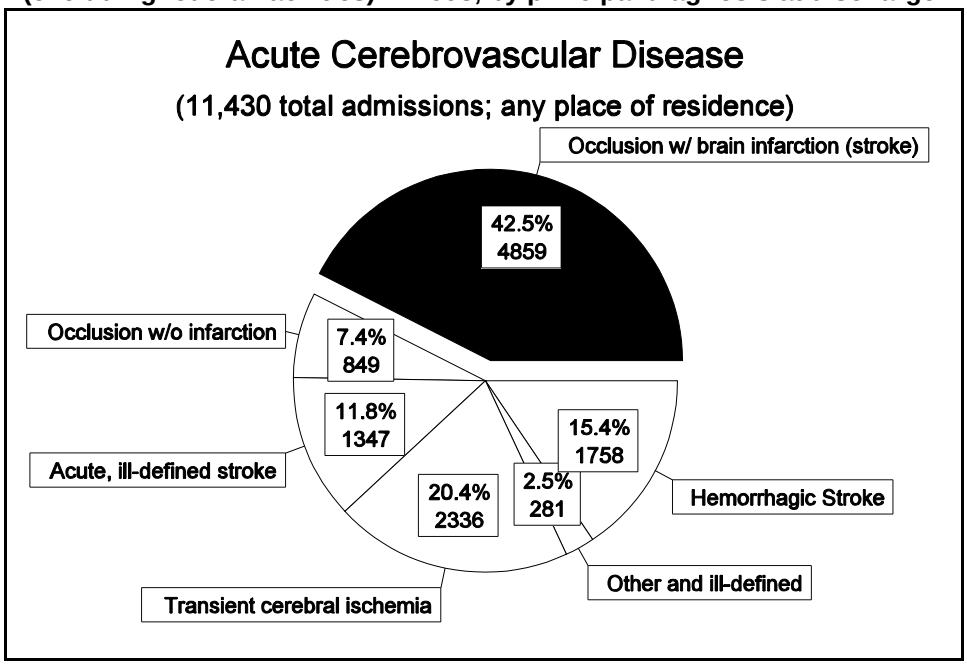
We plan to replicate this analysis and generate the information for discharges occurring in the year 1999 as well. We expect that the combined data from 1998 and 1999 will produce a reasonable baseline from which we can measure the progress of *Operation Stroke* in the decade of the 2000's.

APPENDICES

1. Arizona Statewide Data: Discharges from Any Arizona Hospital

The types of cerebrovascular disease, **in all of Arizona**, seen on an acute basis (where the *admit type* field = emergency or urgent) are displayed in **Figure 7**. This graph may be useful for planning the expansion of *Operation Stroke* from Maricopa county to become a statewide program. See **Table 1** for the definition of the groupings.

Figure 7. Acute cerebrovascular discharges from any Arizona hospital (excluding federal facilities) in 1998, by principal diagnosis at discharge.



2. Discharges From Maricopa County Hospitals

Table 3. Calculation of the age-adjusted rate of Occlusive Stroke seen at hospitals in Maricopa county. The numerator contains cases discharged from hospitals in Maricopa county, regardless of where the patient resided.

Age Group	Hospital cases in 1998	1998 Maricopa Population	Age-specific rate per 100000	Standard Yr 2000 Population Weights	Hospital Cases Projected to the Standard Population
0-4	4	206,477	1.94	0.069135	0.1
5-9	1	216,904	0.46	0.072533	0.0
10-14	0	203,261	0.00	0.073032	0.0
15-19	3	188,660	1.59	0.072169	0.1
20-24	7	189,947	3.69	0.066478	0.2
25-29	6	218,763	2.74	0.064529	0.2
30-34	12	226,633	5.29	0.071044	0.4
35-39	22	233,407	9.43	0.080762	0.8
40-44	42	213,397	19.68	0.081851	1.6
45-49	57	181,664	31.38	0.072118	2.3
50-54	131	150,999	86.76	0.062716	5.4
55-59	175	117,815	148.54	0.048454	7.2
60-64	215	97,590	220.31	0.038793	8.5
65-69	362	97,775	370.24	0.034264	12.7
70-74	433	92,530	467.96	0.031773	14.9
75-79	527	75,693	696.23	0.026999	18.8
80-84	474	48,565	976.01	0.017842	17.4
85+	476	43,240	1100.83	0.015508	17.1
	2947	**2,803,320**	**not applic.**	**1.000000**	**107.7**

Figure 8. Graph to show future trends of hospitalization for occlusive stroke. The rates are age-adjusted to the Year 2000 population. Data come from Table 3 and Table 5.

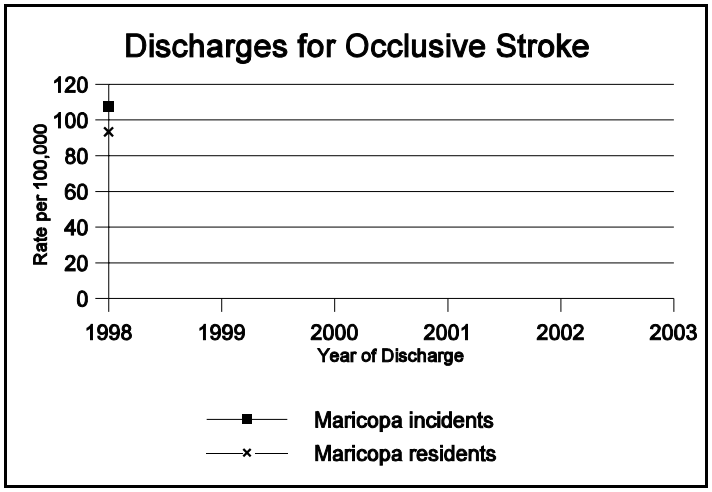


Table 4. Referring source and discharge status of patients hospitalized in Maricopa county hospitals for occlusive stroke in 1998.

	SOURCE OF ADMISSION							
	Physician Referral	Clinic Referral	Health Plan Referral	Transfer from hospital	Transfer from SNF	From another health care facility	E.R.	Total
DISCHARGE STATUS								
To home or self care	161	16	1	45	2	3	813	1041
To another short term general hospital	11	0	0	3	0	0	57	71
To skilled nursing facility	88	3	1	26	10	8	795	931
To intermediate care facility	15	0	0	6	0	0	77	98
To another type of institution	58	6	0	56	1	0	379	500
To home health svc organization	23	0	0	11	1	0	119	154
Left AMA	0	0	0	0	0	0	2	2
Home IV provider	2	0	0	0	0	0	28	30
Expired	10	2	0	12	1	1	94	120
Total	368	27	2	159	15	12	2364	2947

3. Analysis of Maricopa County Residents Only

An argument can be made for an alternative, but more restrictive, approach toward calculating the hospitalization rate for stroke in Maricopa county by choosing as the numerator only cases whose residential zip code, as listed in the HDDB, was in this county. This approach could be useful in tracking primary prevention efforts that may be undertaken in Maricopa county. It is important to note that this approach excludes out-of-state residents (e.g., winter visitors), and Maricopa county residents who are discharged from out-of-state hospitals. However, it includes Maricopa residents who are discharged from non Maricopa hospitals in Arizona. For the denominator we have chosen the Maricopa resident population.[4] We have standardized the rate using the Year 2000 standard US population.[7] For the year 1998 the hospitalization rate for occlusive stroke using this approach was 93.4 per 100,000 population.

Table 5. Calculation of the age-adjusted hospitalization rate of Occlusive Stroke of Maricopa county residents. For this calculation the numerator contained cases living in Maricopa county, regardless of the Arizona hospital from which they were discharged.

Age Group	Incidents in 98	1998 Maricopa Population	Age specific rate per 100000	Standard Yr 2000 Population Weights	Incidents Projected to the Standard Population
0-4	2	206,477	0.97	0.069135	0.1
5-9	0	216,904	0.00	0.072533	0.0
10-14	0	203,261	0.00	0.073032	0.0
15-19	3	188,660	1.59	0.072169	0.1
20-24	7	189,947	3.69	0.066478	0.2
25-29	5	218,763	2.29	0.064529	0.1
30-34	9	226,633	3.97	0.071044	0.3
35-39	18	233,407	7.71	0.080762	0.6
40-44	33	213,397	15.46	0.081851	1.3
45-49	48	181,664	26.42	0.072118	1.9
50-54	114	150,999	75.50	0.062716	4.7
55-59	151	117,815	128.17	0.048454	6.2
60-64	184	97,590	188.54	0.038793	7.3
65-69	300	97,775	306.83	0.034264	10.5
70-74	367	92,530	396.63	0.031773	12.6
75-79	465	75,693	614.32	0.026999	16.6
80-84	426	48,565	877.17	0.017842	15.7
85+	423	43,240	978.26	0.015508	15.2
Total	**2555**	**2,803,320**	**not applic.**	**1.000000**	**93.4**

4. Case Load at Maricopa Hospitals

Table 6. Hospital facilities in Maricopa county which discharged cases of acute, occlusive stroke, 1998.

HOSPITAL NAME	Cases
AMERICAN TRANS - PHOENIX	2
ARIZONA HEART HOSPITAL	3
ARROWHEAD COMMUNITY	79
CHANDLER COMMUNITY	102
COLUMBIA PARADISE VALLEY	62
COLUMBIA REGIONAL MED CT	46
COMMUNITY HOSPITAL	12
DEL E. WEBB MEMORIAL H.	107
DESERT SAMARITAN	147
GOOD SAMARITAN	120
JOHN C. LINCOLN	123
MARICOPA MEDICAL CENTER	53
MARYVALE SAMARITAN	116
MESA GENERAL	105
MESA LUTHERAN	120
PHOENIX BAPTIST	137
PHOENIX CHILDREN'S HOSP.	1
PHOENIX GEN.-DEER VALLEY	16
PHOENIX MEMORIAL	72
SCOTTSDALE HEALTHCARE OS	188
SCOTTSDALE HEALTHCARE SH	210
ST JOSEPH'S HOSP PHOENIX	270
ST. LUKE'S	52
TEMPE ST. LUKE'S	66
THUNDERBIRD SAMARITAN	178
VALLEY LUTHERAN	251
WALTER O. BOSWELL	302
WICKENBURG COMMUNITY	7
Total	2947

ENDNOTES

1. American Heart Association. Annual Report, 1999. page 9. This report can be viewed at http://www.americanheart.org/AnnRep/PDF/AnRep99.pdf .

2. Mrela CK, and Jimenez JM. *Arizona Health Status and Vital Statistics, 1998.* ADHS Office of Epidemiology and Statistics. December 1999.

3. American Heart Association: http://www.americanheart.org/statistics/10econom.html accessed on June 23, 2000.

4. Arizona Dept of Economic Security. *Arizona Population Projections, 1997-2050. Projections Report #2.* ADES Population Statistics Unit. February 1997.

5. Payer code groups: 00, 01 are self-pay and commercial (indemnity). 02, 03 are HMO* and PPO.* 04, 06, 08 09 are various state programs: AHCCCS Health Care Group*, AHCCCS/Medicaid*, CRS*, and Workers Compensation*. 05 is Medicare. 11 is Medicare Risk*. Federal and Other is 07, 10, 12, 13, 14. *We considered these categories to be “managed care.”

6. Wang DZ, Rose JA, Honings DS, Garwacki DJ, Milbrandt JC; for the OSF Stroke Team. Treating acute stroke patients with intravenous tPA. *Stroke*. 2000;31:77-81.

7. The 5-year age-group data was obtained from the National Center for Health Statistics.